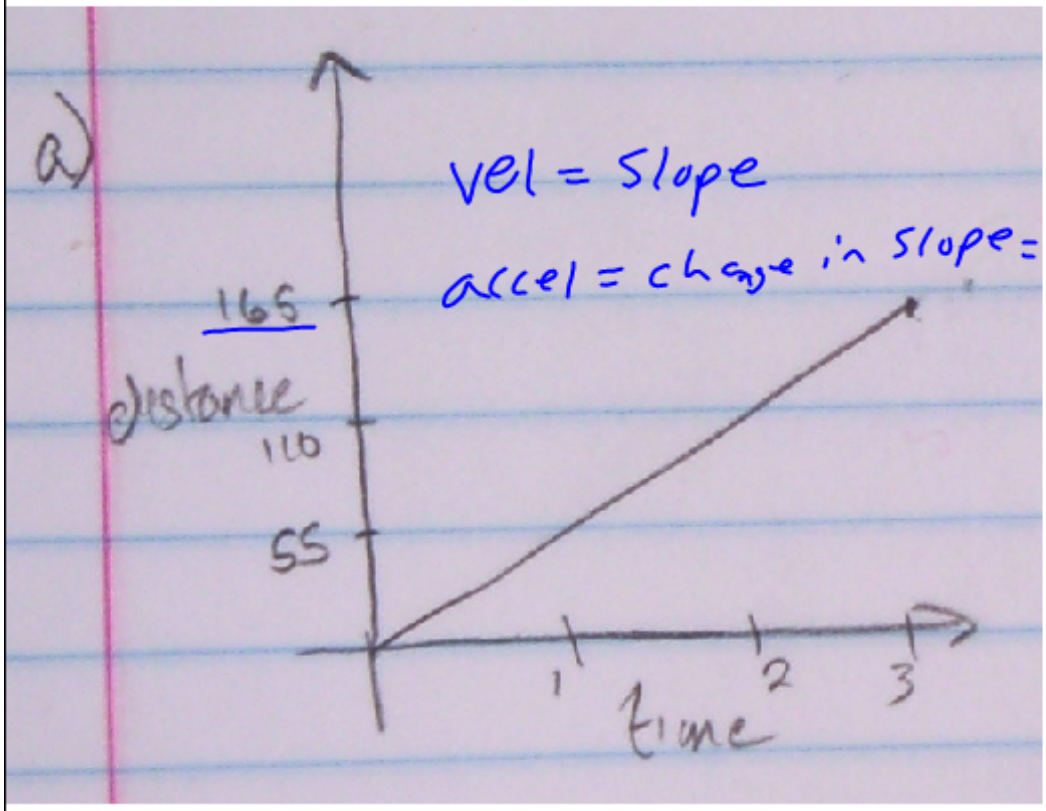
A car drives at a constant rate of 55 mph for 3 hours.

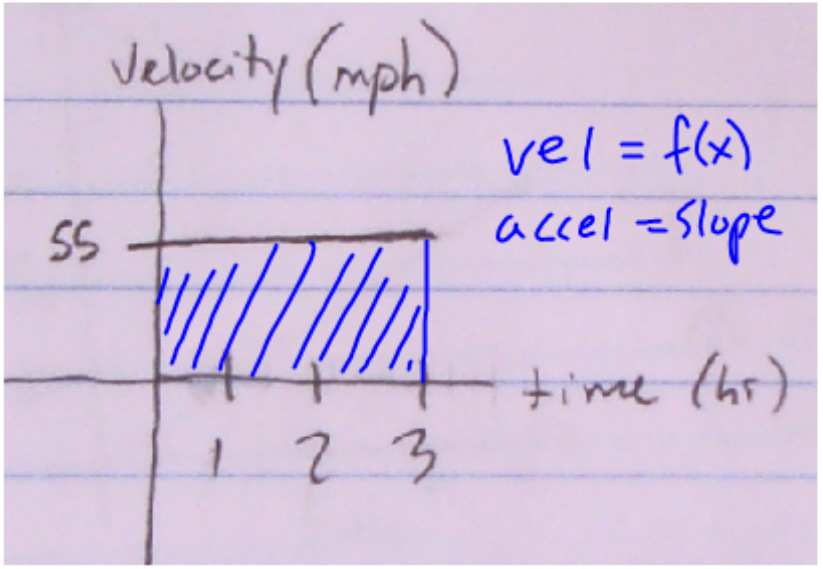
(a) Sketch a graph of this situation (label axes)

(b) How far did the car travel?

(c) How can we see this distance on the graph?

(d) How can we see the vel. and accel?

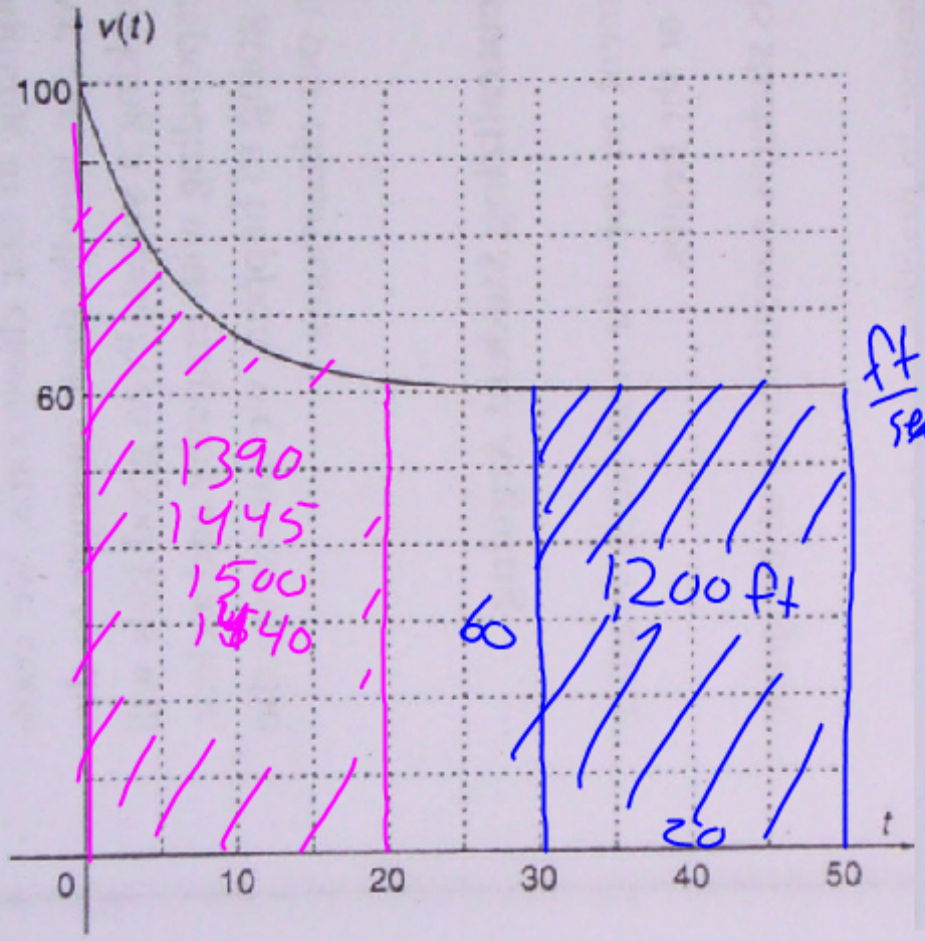




$\frac{mi}{\cancel{h}} \cdot \cancel{h}$ = miles

Definite Integral = Area under a curve

As you drive on the highway you accelerate to 100 feet per second to pass a truck. After you have passed, you slow down to a more moderate 60 ft/sec. The diagram shows the graph of your velocity, $v(t)$, as a function of the number of seconds, t, since you started slowing.



1. What does your velocity seem to be between t = 30 and t = 50 seconds? How far do you travel in the time interval [30, 50]?

2. Explain why the answer to Problem 1 can be represented as the area of a *rectangular* region of the graph. Shade this region.

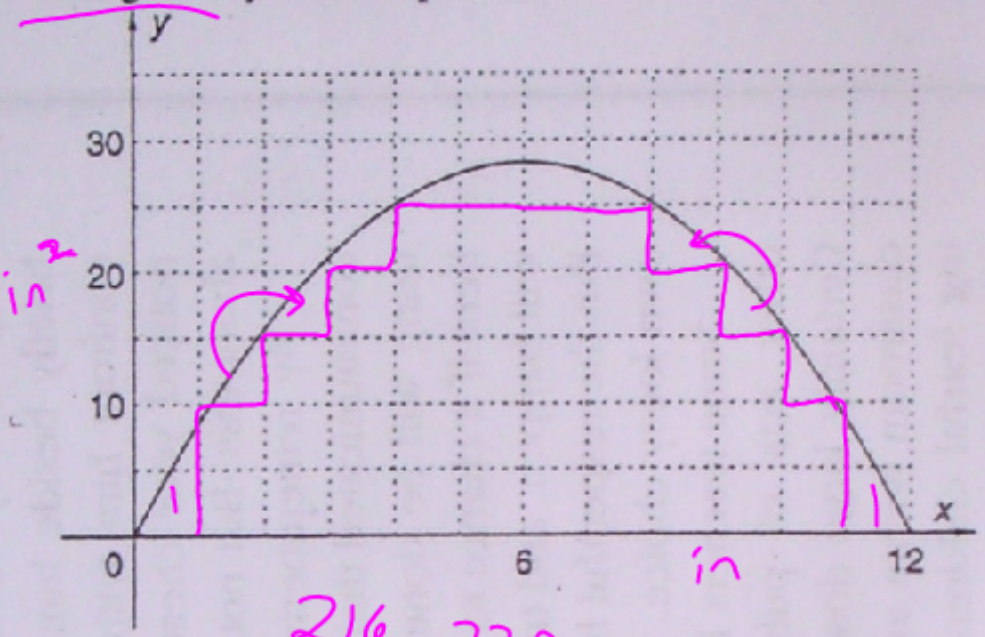
$\frac{ft}{sec} \cdot sec = ft.$

3. The distance you travel between $t = 0$ and $t = 20$ can also be represented as the area of a region bounded by the (curved) graph. Count the number of squares in this region. Estimate the area of parts of squares to the nearest 0.1 square space. For instance, how would you count this partial square?

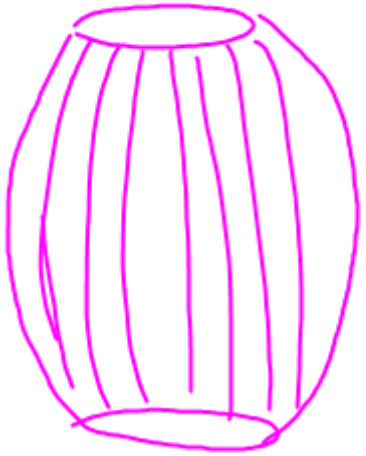
4. How many feet does each small square on the graph represent? How far, therefore, did you go in the time interval [0, 20]?

5. Problems 3 and 4 involve finding the product of the x-value and the y-value for a function where y may *vary* with x. Such a product is called the **definite integral** of y with respect to x. Based on the units of t and $v(t)$, explain why the definite integral of $v(t)$ with respect to t in Problem 4 has feet for its units.

6. The graph shows the cross-sectional area, y square inches, of a football as a function of the distance, x inches, from one of its ends. Estimate the definite integral of y with respect to x.

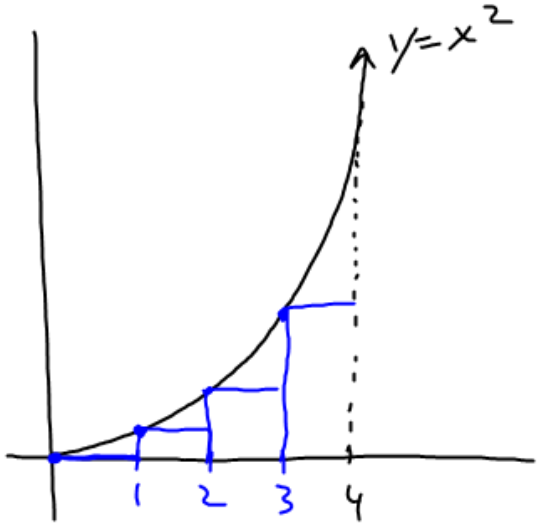


216 228 226
215 225 222

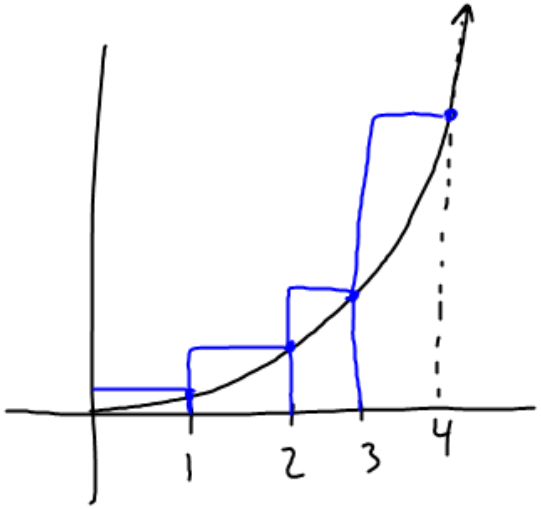


7. What are the units of the definite integral in Problem 6? What, therefore, do you suppose the definite integral represents?

in³

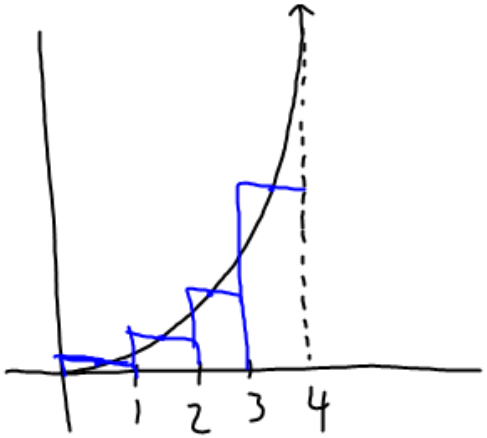


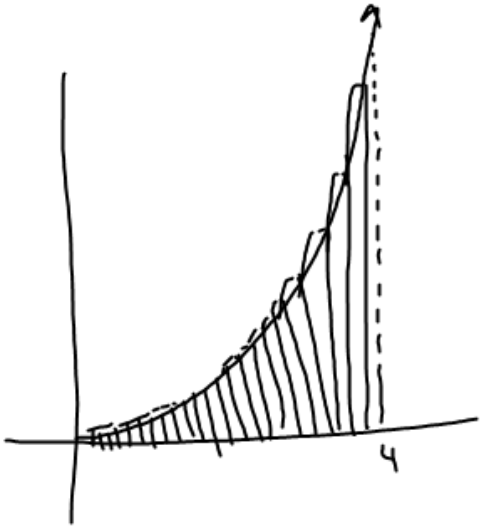
LRAM

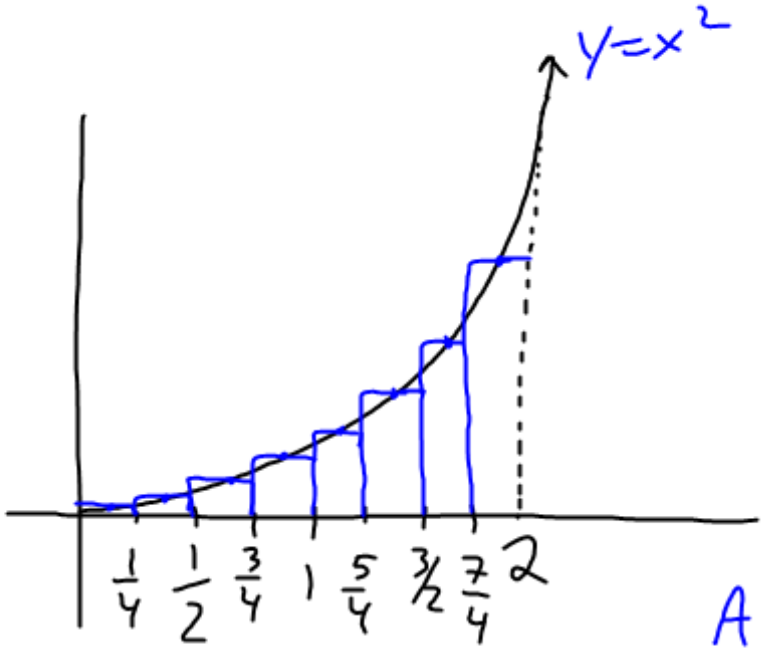


RRAM

MRAM







$$\left(\frac{1}{8}\right)^2 \cdot \frac{1}{4} + \frac{1}{4} \cdot \left(\frac{3}{8}\right)^2 + \frac{1}{4} \cdot \left(\frac{5}{8}\right)^2$$

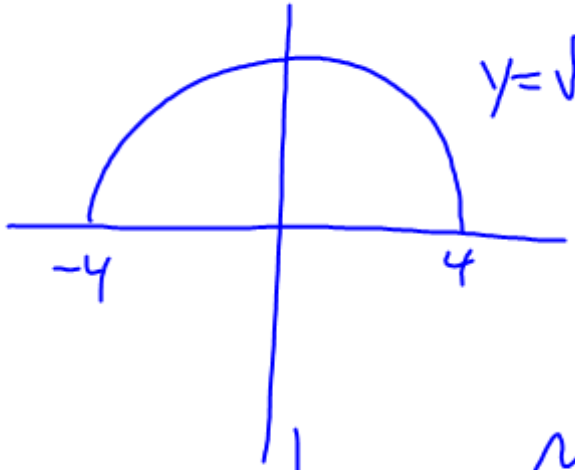
$$A = \frac{1}{4}\left[\frac{1}{64} + \frac{9}{64} + \frac{25}{64} + \frac{49}{64} + \frac{81}{64} + \frac{121}{64} + \frac{169}{64} + \frac{225}{64}\right]$$

$$A \approx 2.656$$

$$A = 2.\overline{66}$$

Error

5.1 #1, 3, 5, 14 (n=10 only), 16, 18-20



$y = \sqrt{16 - x^2}$

use 8 rect. find the best approx possible

$$\frac{|25.471 - 25.133|}{25.133}$$

≈ 1.3% error

MRAM → 25.471

Geom → 25.133

πr^2

$\pi \cdot 4^2 =$